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$$\therefore z^3 + (G/F + K/E + H/D)z^2 + (GK/EF + GH/DF + HK)DEz + GHK/DEF = 0.$$

$$\therefore (z + G/F)(z + K/E)(z + H/D) = 0.$$

$\therefore$  The roots are  $-G/F$ ,  $-K/E$ ,  $-H/D$ , or

$$\frac{2\gamma - \alpha - \beta}{2\alpha\beta - \gamma\alpha - \gamma\beta}, \quad \frac{2\beta - \alpha - \gamma}{2\gamma\alpha - \beta\gamma - \beta\alpha}, \quad \frac{2\alpha - \beta - \gamma}{2\beta\gamma - \alpha\beta - \alpha\gamma}.$$

## PROBLEMS FOR SOLUTION.

### ALGEBRA.

185. Proposed by L. E. DICKSON, Ph. D., Assistant Professor of Mathematics, The University of Chicago.

Without introducing radicals, eliminate  $x$  and  $y$  from the equations

$$ax^2 + bx + c = 0, \quad ay^2 + by + d = 0, \quad ax^2y^2 + bxy + e = 0.$$

186. Proposed by L. E. DICKSON, Ph. D., Assistant Professor of Mathematics, The University of Chicago.

Eliminate  $x$  and  $y$  from the equations

$$ax^3 + bx^2 + cx + d = 0,$$

$$ay^3 + by^2 + cy + e = 0,$$

$$ax^3y^3 + bx^2y^2 + cxy + f = 0,$$

the eliminant to be rational in  $d, e, f$ .

### GEOMETRY.

207. Proposed by W. W. HART, University High School, Chicago, Ill.

According to Gauss the circumference of a circle can be divided into  $n$  equal parts by ruler and compass when and only when  $n$  is a prime of the form  $2 \cdot 2^p + 1$ .

The following construction gives good partial results for  $n$  equals *any* integer. If  $AB$  is the diameter of the circle, and  $C$  is the vertex of the equilateral triangle  $ABC$ , and if  $D$  is a point on  $AB$  at the distance  $2AB/n$  from  $A$ , then draw the line  $CD$  cutting the circle at  $E$  and  $F$ ;  $E$  being the more remote from  $C$ .  $AE = 1/n$  circumference approximately. For low values of  $n$  this method is very practical; is it practical in general? How great is the error?

208. Proposed by W. J. GREENSTREET, A. M., Editor of The Mathematical Gazette, Stroud, England.

Tangents drawn to two confocal parabolas from a point on the common tangent intersect at the same angle as the axes of the parabolas.